

WE CLAIM:

1. A fuel processor, comprising:

a shell including at least one input adapted to receive a feed stream containing a feedstock and at least one output adapted to emit a product hydrogen stream containing at least substantially pure hydrogen gas;

a hydrogen-producing region at least partially contained within the shell and adapted to receive the feed stream and to produce a mixed gas stream containing hydrogen gas and other gases therefrom; and

a separation region adapted to receive the mixed gas stream and to separate the mixed gas stream into a hydrogen-rich stream forming at least a substantial portion of the product hydrogen stream and containing at least substantially hydrogen gas and a byproduct stream containing at least substantially the other gases;

wherein at least a portion of the fuel processor is a modular component that is adapted to be accessed, removed from and replaced as a unit into an operational position of the fuel processor.

2. The fuel processor of claim 1, wherein the modular component is adapted to receive a gas-containing stream having a composition and to outlet a gas-containing stream having a different composition.

3. The fuel processor of claim 1, wherein one of at least a portion of the separation region or a portion of the hydrogen-producing region forms the modular component and is adapted to be independently removable from the other of at least a portion of the separation region or a portion of the hydrogen-producing region.

4. The fuel processor of claim 1, wherein the modular component is operatively coupled to the fuel processor by at least one releasable fitting.

5. The fuel processor of claim 4, wherein the at least one releasable fitting establishes fluid communication between the modular component and another portion of the fuel processor.

6. The fuel processor of claim 4, wherein the at least one releasable fitting is adapted to selectively retain the modular component in an operative position forming a portion of the fuel processor.

7. The fuel processor of claim 1, wherein the shell includes at least one access port through which the modular component may be accessed, removed and reattached through the shell.

8. The fuel processor of claim 7, wherein the modular component is operatively coupled to the fuel processor by at least one releasable fitting and further wherein the at least one releasable fitting is positioned for access, release and reattachment by a user through the access port.

9. The fuel processor of claim 1, wherein the fuel processor includes a plurality of modular components, each adapted to be accessed, removed from and replaced into an operative position as a portion of the fuel processor.

10. The fuel processor of claim 9, wherein the shell includes a plurality of access ports, each adapted to selectively permit access to, removal and replacement of at least one modular component from the fuel processor.

11. The fuel processor of claim 1, wherein the hydrogen-producing region is completely contained within the shell.

12. The fuel processor of claim 1, wherein the hydrogen-producing region includes a reforming region containing at least one reforming catalyst bed.

13. The fuel processor of claim 12, wherein the modular component includes the reforming region.

14. The fuel processor of claim 12, wherein at least a portion of the reforming region forms at least a substantial portion of the modular component.

15. The fuel processor of claim 12, wherein the modular component includes a reforming catalyst bed that is adapted to be removed and replaced as a unit from the fuel processor relative to the rest of the reforming region.

16. The fuel processor of claim 15, wherein the reforming region includes a plurality of reforming catalyst beds, each forming a separate modular component that is adapted to be removed and replaced as a unit from the fuel processor relative to the rest of the reforming region.

17. The fuel processor of claim 1, wherein the separation region is at least partially contained within the shell.

18. The fuel processor of claim 1, wherein the separation region is completely contained within the shell.

19. The fuel processor of claim 1, wherein the separation region is adapted to separate the mixed gas stream into the hydrogen-rich stream and the byproduct stream via a pressure-driven separation process.

20. The fuel processor of claim 1, wherein the separation region includes at least one hydrogen-selective membrane.

21. The fuel processor of claim 20, wherein the modular component includes the at least one hydrogen-selective membrane.

22. The fuel processor of claim 1, wherein the separation region includes a membrane module containing a plurality of hydrogen-selective membranes.

23. The fuel processor of claim 22, wherein the membrane module further includes a pair of end plates between which the hydrogen-selective membranes are mounted.

24. The fuel processor of claim 23, wherein the membrane module includes at least one output port through which the byproduct stream is removed from the membrane module, and at least one output port through which the hydrogen-rich stream is removed from the membrane module.

25. The fuel processor of claim 22, wherein the modular component includes the membrane module and is adapted to be accessed, removed from and replaced into an operative position relative to the fuel processor.

26. The fuel processor of claim 22, wherein at least a portion of the membrane module forms at least a substantial portion of the modular component.

27. The fuel processor of claim 1, wherein the fuel processor further includes a filter assembly adapted to remove particulate from the mixed gas stream.

28. The fuel processor of claim 27, wherein the modular component includes the filter assembly.

29. The fuel processor of claim 27, wherein at least a portion of the filter assembly forms at least a substantial portion of the modular component.

30. The fuel processor of claim 27, wherein the filter assembly includes at least one filter element.

31. The fuel processor of claim 30, wherein at least one of the at least one filter elements forms the modular component.

32. The fuel processor of claim 27, wherein the filter assembly is located at least partially within the shell.

33. The fuel processor of claim 27, wherein the filter assembly is located external the shell.

34. The fuel processor of claim 27, wherein the modular component includes the separation region and the filter assembly.

35. The fuel processor of claim 1, wherein the fuel processor further includes a purification region adapted to receive the hydrogen-rich stream and to reduce the concentration of selected components of the hydrogen-rich stream to form a product hydrogen stream.

36. The fuel processor of claim 35, wherein the modular component includes the purification region.

37. The fuel processor of claim 35, wherein at least a portion of the purification region forms at least a substantial portion of the modular component.

38. The fuel processor of claim 35, wherein the purification region includes a methanation catalyst bed.

39. The fuel processor of claim 38, wherein the modular component includes the methanation catalyst bed.

40. The fuel processor of claim 38, wherein the purification region further includes a reforming catalyst bed.

41. The fuel processor of claim 40, wherein the reforming catalyst bed is upstream from the methanation catalyst bed.

42. The fuel processor of claim 40, wherein the modular component includes the reforming catalyst bed.

43. The fuel processor of claim 1, wherein the fuel processor includes an air delivery system adapted to deliver an air stream to the fuel processor.

44. The fuel processor of claim 43, wherein the fuel processor includes a combustion chamber with a heating assembly and the air delivery system is adapted to deliver the air stream to the heating assembly.

45. The fuel processor of claim 43, wherein the fuel processor includes a combustion chamber and the air delivery system is adapted to selectively deliver the air stream to the combustion chamber to regulate the temperature of the combustion chamber.

46. The fuel processor of claim 1, in combination with at least one hydrogen-consuming device adapted to receive at least a portion of the product hydrogen stream from the fuel processor.

47. The fuel processor of claim 46, further including a housing in which the fuel processor and the at least one hydrogen-consuming device are contained.

48. The fuel processor of claim 46, wherein the fuel processor and the at least one hydrogen-consuming device are integrated together.

49. The fuel processor of claim 46, wherein the at least one hydrogen-consuming device includes a motor vehicle.

50. The fuel processor of claim 46, wherein the at least one hydrogen-consuming device includes a household appliance.

51. The fuel processor of claim 1, in combination with a fuel cell stack adapted to receive at least a portion of the product hydrogen stream from the fuel processor and to produce an electric current therefrom.

52. The fuel processor of claim 51, further including a housing in which the fuel processor and the fuel cell stack are contained.

53. The fuel processor of claim 51, wherein the fuel processor and the fuel cell stack are integrated together to provide an energy-producing device with an integrated hydrogen-producing system.

54. The fuel processor of claim 51, in further combination with at least one energy-consuming device adapted to draw the electric current from the fuel cell stack.

55. The fuel processor of claim 54, further including a housing adapted to receive the fuel processor, fuel cell stack and the at least one energy-consuming device.

56. The fuel processor of claim 54, wherein the fuel processor, fuel cell stack and the at least one energy-consuming device are integrated together to provide an energy-consuming device with an integrated energy-producing system.

57. The fuel processor of claim 54, wherein the at least one energy-consuming device includes a heater.

58. The fuel processor of claim 54, wherein the at least one energy-consuming device includes a motor vehicle.

59. The fuel processor of claim 54, wherein the at least one energy-consuming device includes an appliance.

60. The fuel processor of claim 54, wherein the at least one energy-consuming device includes a lighting assembly.

61. The fuel processor of claim 54, wherein the at least one energy-consuming device includes communications equipment.

62. The fuel processor of claim 54, wherein the at least one energy-consuming device includes signaling equipment.

63. The fuel processor of claim 54, wherein the at least one energy-consuming device includes a seacraft.

64. The fuel processor of claim 54, wherein the at least one energy-consuming device includes a dwelling.

65. An integrated hydrogen-consuming device and hydrogen producing assembly, the device comprising:

a fuel processor adapted to produce a product hydrogen stream containing at least substantially pure hydrogen gas from a feed stream and including at least one modular component that is adapted to be removed and replaced as a unit from the fuel processor; and

a hydrogen-consuming device adapted to receive at least a portion of the product hydrogen stream.

66. An integrated power-consuming device and energy producing assembly, the device comprising:

a fuel processor adapted to produce a product hydrogen stream containing at least substantially pure hydrogen gas from a feed stream and including at least one modular component that is adapted to be removed and replaced as a unit from the fuel processor; and

a fuel cell stack adapted to receive at least a portion of the product hydrogen stream from the fuel processor and to produce an electric current therefrom; and

a power-consuming device adapted to draw at least a portion of the electric current from the fuel cell stack.

67. In a fuel processor adapted to produce hydrogen gas from a feed stream, the improvement comprising at least one cartridge-based component forming an operative portion of the fuel processor and being adapted to be accessed, removed from and placed as a unit into an operative position as a portion of the fuel processor.

68. The fuel processor of claim 67, wherein each of the at least one cartridge-based components is removably coupled in the operative position by at least one releasable fitting.

69. The fuel processor of claim 67, wherein the fuel processor includes a shell containing an access port through which at least one of the at least one cartridge-based components may be accessed, removed from and replaced as a unit into the operative position within the fuel processor.

70. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a hydrogen-producing region adapted to receive the feed stream and produce a stream containing hydrogen gas therefrom.

71. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a separation region adapted to receive a mixed gas stream containing hydrogen gas and other gases and to separate the mixed gas stream into a hydrogen-rich stream containing at least substantially hydrogen gas and a byproduct stream containing at least substantially the other gases.

72. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a filter assembly adapted to remove particulate from a stream delivered thereto.

73. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a filter element adapted to remove particulate from a stream delivered thereto.

74. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a reforming region containing a reforming catalyst and adapted to receive the feed stream and to produce a mixed gas stream containing hydrogen gas and other gases therefrom.

75. The fuel processor of claim 67, wherein the at least one cartridge-based component includes a bed containing a reforming catalyst.